able load, and of a pivot bearing. (2) The pressure in a viscous liquid moving through a channel with diverging boundaries.

MANCHESTER.

Literary and Philosophical Society, November 18.—Prof. F. E. Weiss, deputy chairman, in the chair.—Prof. T. H. **Pear**: The elimination of wasteful effort in industry. Owing to the impossibility of being able to distinguish sharply between physical and mental effort in the investigation of the problems of economising human energy, physiology and psychology must work side by side. While in many industries improvement of the external conditions of work, such as temperature, ventilation, humidity, and illumination, was rapidly proceeding, less had been attempted in the direction of improving the methods of work themselves. Examples of such efforts illustrated the importance of certain fundamental principles. The first was the adjustment, both in total length and in distribution, of rest-pauses. By introducing suitably chosen rest-pauses and by modifying the working attitude of girls who were engaged in folding handkerchiefs, the output increased 300 per cent., while the folders worked only forty-five minutes in each hour, and were less fatigued than before. The second principle was the substitution of habitual movements for constant acts of decision. By rearranging the method of "assembling" a braid machine, so that the parts were not only put together in a more efficient order, but were more easily found by the workman, sixty-six units were assembled by a man in one day instead of eighteen. The third was the elimination of useless movement. By this means the separate actions required to lay a brick had been reduced from 18 to 5; the output increased from 120 per man per hour to 350.

PARIS.

Academy of Sciences, November 17.—M. Léon Guignard in the chair.—C. **Moureu** and A. **Lepape**: The stabilisation of acrolein. Preparation of acrolein. A mixture of potassium bisulphate (5 parts) and potassium sulphate (1 part) is recommended as the best catalytic agent for dehydrating glycerol to acrolein, and full details of the best method of carrying out the preparation on the large scale are given.—J. **Carpentier**: An account of the presentation (made on November 10) of colour kinematographs of the Gaumont establishment. Progress in the application of three-colour photography to the kinematograph has been rapid, and it is now practicable to take kinematographic views in colour.—Sir J. J. Thomson was elected a foreign associate in succession to the late M. Dedekind.—G. **Bouligand**: Solutions of the equation $\Delta u=\lambda u$, analytic and limited in an infinite domain, zero on the frontier.—N. E. **Nörlund**: The calculation of finite differences.—H. **Dulac**: Limit cycles.—O. **Mayer**: Ruled surfaces of the fourth order.—P. **Humbert**: The approximate calculation of the elements of critical Jacobians of a high order.—E. **Belot**: The structure of our stellar universe, deduced from the dualist and vortex cosmogony.—G. **Fayet**: Return of Finlay's periodic comet. This is identical with the comet discovered by Sasaki at Kyoto (Japan) on October 25. From data calculated by the author it was again found by M. Schaumasse at Nice on November 9.—M. **Michkovitch**: Observation of Finlay's periodic comet made at the Marseilles Observatory with the 26-cm. Eichens equatorial. The positions of the comet and comparison star are given for November 10. The comet was well defined and of about the ninth magnitude.—M. **Giacobini**: Observations of the Sasaki (Finlay's) comet made at the Paris Observatory. Positions are given for November 12 and 16.—P. **Chofardet**: Observations of Finlay's periodic comet (1919*e*) made at the Besançon Observatory. Position given for November 13.—A. **Schaumasse**: Observations of Finlay's periodic comet made at the Nice Observatory. Positions given for November 9, 10, 11, 12, and 13.—A. **Baldit**: The effect produced by the electricity of rain on an insulated wire. An insulated wire exposed to rain behaves as a potential equaliser. The disturbances known to occur in electrical systems with air-cables during rainstorms arise from the terrestrial electric field.—A. **Chéron**: An apparatus for the simultaneous examination of the same stereoscopic plate by two persons.—A. **Lartigne**: A new form for the formulæ of line spectra. The formula, deduced from the point of view of general mechanics, is

$$\lambda_m=\frac{4\times10^8}{N_0}\left(\frac{p}{2}\right)^3\left(\frac{2}{p}+\frac{1}{m}-\frac{1}{m+2p}\right)\text{Angstroms},$$

in which λ is the wave-length, N_0 the Rydberg universal constant, p a constant, and $m=(q-p)$, differing only slightly from consecutive numbers. For $p=2$, and $m=q-2=1, 2, 3 \ldots 29$, the formula is identical with Balmer's original series for hydrogen.—G. A. **Hemsalech**: The luminous phenomena observed in the neighbourhood of a plate of graphite carried to a high temperature by an electric current.—H. **Ungemach**: A remarkable deposit of chalcostibite in Morocco. This mineral is rare, and has hitherto been found in only three localities, in minute quantities and as small crystals. The deposit at Rar-el-Anz, in Morocco, is extensive, and the crystals are large and well formed. One measured 9×4×1 cm.—R. **Souèges**: The embryogeny of the Polygonaceæ. Development of the embryo in Rumex and Rheum.—MM. P. **Mazé**, **Vila**, and M. **Lemoigne**: The transformation of cyanamide into urea by the micro-organisms of the soil. Of the three organisms chosen one, *B. coli,* has no action upon cyanamide; the others, *B. prodigiosus* and *B. cloacae,* convert the cyanamide completely into urea, traces only of ammonia being found.—H. **Bierry**: Carnivora and the three classes of food. It appears improbable, from both observation and experiment, that carnivora can thrive on a diet deprived of both fats and carbohydrates.—F. **Mesnil** and M. **Caullery**: A normal process of fragmentation, followed by regeneration, in a polychetal Annelid, *Syllis gracilis*.—A. **Krempf**: Development of muscular layers in the larva of an Anthozoa (*Pocillopora cespitosa*) at the primitive stage of tetraradial symmetry.—F. **d'Hérelle**: The *rôle* of the protecting micro-organism in bird-typhus.—C. **Nicolle** and C. **Lebailly**: The evolution of the spirochetæ of recurrent fever in the louse, as followed in a series of sections of these insects.

BOOKS RECEIVED.

Psychologies. By Sir R. Ross. Pp. 69. (London: J. Murray.) 2*s*. 6*d*. net.

La Colloidothérapie: Résultats Cliniques. By Dr. J. Laumonier. Pp. ii+283. (Paris: F. Alcan.) 5.50 francs.

A New Chapter in the Science of Government. By B. Branford. Pp. xlviii+190. (London: Chatto and Windus.) 5*s*. net.

A Study of Trade Organisations and Combinations in the United Kingdom. By J. Hilton. Pp. 138. (London: Harrison and Sons.) 1*s*. net.

Altitude and Health. By Prof. F. F. Roget. Pp. xii+186. (London: Constable and Co., Ltd.) 12*s*. net.

Forest Woods and Trees in Relation to Hygiene. By Prof. A. Henry. Pp. xii+314. (London: Constable and Co., Ltd.) 18*s*. net.

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The Hardwoods of Australia and their Economics. By R. T. Baker. Pp. xvi+522+plates. (Sydney: The Technological Museum.)

Alternating Current Work: An Outline for Students of Wireless Telegraphy. By A. Shore. Pp. ix+163. (London: The Wireless Press, Ltd.) 3*s.* 6*d.* net.

Telephony without Wires. By P. R. Coursey. Pp. xix+414. (London: The Wireless Press, Ltd.) 15*s.* net.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 11.

ROYAL SOCIETY, at 4.30.—C. F. U. Meek: A Further Study of Chromosome Dimensions.—J. M. H. Campbell, C. G. Douglas, and F. G. Hobson: The Respiratory Exchange of Man During and After Muscular Exercise.—Dr. A. D. Waller: The Energy Output of Dock Labourers during Heavy Work.—C. H. Usher: Histological Examination of an Adult Human Albino's Eyeball, with a Note on Mesoblastic Pigmentation in Fœtal Eyes.—J. Gray: The Relation of Spermatozoa to Certain Electrolytes, II.

LINNEAN SOCIETY, at 5.—Prof. W. A. Herdman: Notes on the Abundance of Marine Animals and a Quantitative Survey of their Occurrence.—J. B. Gatenby: The Fertilisation of the Calcareous Sponges.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Charles A. Ballance: The Surgery of the Heart (Bradshaw Lecture).

ROYAL INSTITUTE OF PUBLIC HEALTH, at 5.—Dr. H. H. Thomson: The Diagnosis and Treatment of Tuberculosis in Relation to Public Health.

MATHEMATICAL SOCIETY (at Burlington House), at 5.—Major P. A. MacMahon: Permutations, Lattice Permutations, and the Hypergeometric Series.—L. J. Mordell: The Generating Function of the Series $\Sigma F(n)q^n$, where $F(n)$ is the Number of Uneven Classes of Binary Quadratics of Determinant $-n$.—H. Steinhaus: Fourier Coefficients of Bounded Functions.—D. Priabandrinsky: Steady Fluid Motions with Free Surfaces.

INSTITUTION OF ELECTRICAL ENGINEERS (at the Institution of Civil Engineers), at 6.—Capt. J. M. Scott Maxwell: Scientific Management—A Solution of the "Capital and Labour" Problem.

OIL AND COLOUR CHEMISTS' ASSOCIATION (at 2 Furnival Street, E.C.), at 7.—The Principle of Application of Paint and Varnish, and How it Affects the Works Chemist of the Paint and Varnish Industry.

OPTICAL SOCIETY, at 7.30.

INSTITUTION OF AUTOMOBILE ENGINEERS (Graduate Section) (28 Victoria Street), at 8.—Debate: Worm *v.* Bevel Drive.

ROYAL SOCIETY OF MEDICINE (Neurology Section), at 8.30.—Certain Late Effects of Injuries of the Nervous System.

FRIDAY, DECEMBER 12.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.—Conference of Research Organisations (at Institution of Civil Engineers), at 2.30.—Rt. Hon. A. J. Balfour: Introductory Address.—H. J. W. Bliss: Research Associations and Consulting Work and the Collecting and Indexing of Information.—Dr. W. Lawrence Balls: The Equipment of Research Laboratories.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Prof. Eddington and Others: Consideration of the Theory of Relativity.

PHYSICAL SOCIETY OF LONDON, at 5.—Prof. W. M. Coleman: First Steps in the Experimental Analysis of a Galvanic Cell.—J. W. T. Walsh: Radiation from a Perfectly Diffusing Circular Disc.—Dr. N. W. McLachlan: A Comparative Method of Testing Thermionic Valves for Passing No Reverse Current at High Voltages.—Dr. A. O. Rankine: Recording and Reproducing Sounds by Means of Light.

ROYAL SOCIETY OF MEDICINE (Clinical Section), at 5.

MALACOLOGICAL SOCIETY OF LONDON (at the Linnean Society), at 6.—Rev. Dr. A. H. Cooke: An Abnormality of Structure in the Radula of Certain Rhachiglossate Mollusca.—H. Watson: The Affinities of Pryamidula, Acanthinula, and Vallonia.

MONDAY, DECEMBER 15.

INSTITUTION OF ELECTRICAL ENGINEERS (Informal Meeting) (at Chartered Institute of Patent Agents), at 7.—R. Rankin and Others: Discussion on Some Reflections on Labour.

FARADAY SOCIETY (at the Chemical Society), at 8.—Lieut. W. A. Macfadyen: Electrolytic Iron Deposition.—A. G. Tarrant: The Measurement of Physical Properties at High Temperatures.—J. G. Williams: The Electrolytic Formation of Perchlorate from Chlorate.—Prof. A. W. Porter: The Vapour Pressures of Binary Mixtures.—S. Horiba: Some Relations between the Solubilities of Solutes and their Molecular Volumes.—Dr. E. J. Hartung: (1) An Accurate Method for the Determination of Vapour Pressure; (2) Some Properties of Copper Ferrocyanide.—Prof. E. D. Campbell: The Solution Theory of Steel and the Influence of Changes in Carbide Concentration on the Electrical Resistivity.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.—S. Perks: London Town-Planning Schemes in 1666.

ROYAL SOCIETY OF ARTS, at 8.—Dr. J. T. Hewitt: Synthetic Drugs (Cantor Lecture).

SURVEYORS' INSTITUTION, at 8.—Discussion on The Future of the Institution.

ROYAL GEOGRAPHICAL SOCIETY (at the Æolian Hall), at 8.30.—Capt. E. H. Keeling: In Northern Anatolia, 1917.

TUESDAY, DECEMBER 16.

ROYAL SOCIETY OF MEDICINE, at 5.—General Meeting of Fellows.

ROYAL STATISTICAL SOCIETY, at 5.15.—J. E. Allen: Some Changes in the Distribution of the National Income during the War.

INSTITUTION OF PETROLEUM TECHNOLOGISTS (at Royal Society of Arts), at 5.30.—A. J. Wilson: The Application of Liquid Fuel to Heavy-Oil Engines.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—Major E. O. Henrici: Precise Levelling.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Technical Meeting), at 7.—N. E. Luboshez: Fancy Lighting in Portraiture.

ILLUMINATING ENGINEERING SOCIETY (at Royal Society of Arts), at 8.—Capt. W. A. Howells: The Art of Camouflage.

WEDNESDAY, DECEMBER 17.

SOCIETY OF GLASS TECHNOLOGY (at Institute of Chemistry), at 2.—J. Connolly, Dr. M. W. Travers, and Dr. W. E. S. Turner: The Position of the Glass Industry in America.

ROYAL UNITED SERVICE INSTITUTION, at 3.—Major-Gen. Sir Lewis Jackson: Possibilities of the Next War.

ROYAL SOCIETY OF ARTS, at 4.30.—C. Grunwald: The Present Economic Position of Russia, and Some Aspects of its Future Development.

ROYAL METEOROLOGICAL SOCIETY, at 5.—F. J. W. Whipple: The Laws of Approach to the Geostrophic Wind.—G. M. B. Dobson: Winds and Temperature Gradients in the Stratosphere.—Capt. C. J. P. Cave: Quotations from the Diary of Samuel Pepys on the Weather.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—Secretary of State for the Colonies: An Earthquake at Rabaul in May, 1919.—R. R. Lempriere The Raised Beach at South Hill (Jersey).—Prof. S. J. Shand: A Rift-Valley in Western Persia.

INSTITUTION OF ELECTRICAL ENGINEERS (Wireless Section) (at Institution of Civil Engineers), at 6.—Prof. G. W. O. Howe: High-Frequency Resistance of Wires and Coils.

ROYAL MICROSCOPICAL SOCIETY (at the Northampton Polytechnic Institute), 7.30–10.30.—Conversazione.

THURSDAY, DECEMBER 18.

ROYAL SOCIETY OF ARTS, at 4.30.—P. J. Hartog: Some Problems of Indian Education.

INSTITUTION OF MINING AND METALLURGY (at Geological Society), at 5.30.—Adjourned Discussion on A Contribution to the Study of Flotation, H. L. Sulman.

INSTITUTION OF ELECTRICAL ENGINEERS (at Institution of Civil Engineers), at 6.—D. M. W. Hutchison and W. J. Wayte: Electricity in Tin Mining.

ARISTOTELIAN SOCIETY (at 22 Albemarle Street), at 8.—Dr. G. E. Moore: External and Internal Relations.

CHEMICAL SOCIETY, at 8.—Prof. J. Walker: War Experiences in the Manufacture of Nitric Acid and the Recovery of Nitrous Fumes.

FRIDAY, DECEMBER 19.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—G. W. Burley: Cutting Power of Lathe Turning Tools, Part II.

SATURDAY, DECEMBER 20.

PHYSIOLOGICAL SOCIETY (at St. Thomas's Hospital), at 4.30.

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